# focus

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ALICE TAYLOR, EDITOR

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## Poliomyelitis in the United States

From early June to late November parents all over the country will be dreading the appearance in their homes of unexplained sickness. Although we know that polio is caused by a virus, we do not know why there seems to be more virus around at certain times of the year than at others, or how the virus is transmitted from one person to another; and we do not know how to prevent or to cure the disease. So far, little has been found to allay our fears. One of the more promising theories, endorsed by many experts at the present time, is that geographical factors may be important in explaining both the pattern of epidemics and the means of transmission.

Polio seems to have existed throughout the world since antiquity. It was already well known in the United States at the end of the eighteenth century: a refugee from the French Revolution described how her little daughter was stricken in Albany by a form of paralysis "very common here." But it was not until 1840 that polio was described as such (in Germany), and accurate records of cases in the United States date from the early 1900's.

It is, however, often difficult to recognize polio. For every recognized case, it is estimated that there are 100 that pass unlabeled. A large number of cases produce only temporary muscular symptoms or no muscular symptoms at all. As there is no simple laboratory test to determine the presence of polio, most surveys of the disease are based only on paralytic cases, in which the diagnosis is reasonably certain. A survey made by Dr. Selwyn D. Collins of the United States Public Health Service revealed that, out of 1,000 living children 15 to 19 years old, about 6 had had polio at some time, and out of this number 4 became paralyzed and 3 of these were permanently affected.

As may be seen on the map, every populated area in the United States has been hit by polio at one time or another since 1900. Since 1920 epidemics have been more frequent and more widespread, but not all parts of the country have been equally affected: epidemics have consistently struck more severely in the Northern and Midwestern States than anywhere else. The worst epidemics recorded in the last 50 years occurred in Minnesota (3,183 cases in 1946), New York (13,223 cases in 1916), and North and South Dakota (respectively 492 cases in 1946 and 938 cases in 1948): more than 80 persons in 100,000 had polio, as compared with 14 in 100,000 in other parts of the country.

The distribution pattern of epidemics also shifts from year to year. No region is hard hit twice in succession: the eastern part of the country suffers more one year, the western part more the next.

Although no conclusive explanation of the regional and yearly distribution of epidemics has been found, there seem to be certain constant geographical factors that influence the occurrence of the disease, which it may be fruitful to study.

First among these are heat and humidity. Wherever in the world there are clear-cut changes of climate from season to season, polio breaks out in epidemic form only at certain specific times. As the inset charts indicate, all parts of the United States experience their worst epidemics immediately after the hottest and most humid weeks of the year. A study made by the National Foundation for Infantile Paralysis shows that the number of polio cases remains about the same until late in May, increases slowly until the end of July, then rises more quickly, reaching a peak between August 5 and September 15. Thereafter the number of cases gradually decreases, except for an occasional short rise during one week in the middle of October, and it returns to normal on or about December 15.

A similar seasonal distribution is found in the parts of the Southern Hemisphere where seasons are clear-cut (that is, the extra-tropical parts). The peak coincides with the week following the highest temperatures and the highest humidity of the year.

In the tropics, on the contrary, where the temperature varies but slightly from month to month, polio epidemics may occur at any time.

Another factor that seems to influence epidemics in the United States is the density of population. Although there are proportionately more cases in larger cities than in small, the mortality rates (number of deaths against number of cases) are lower in the large cities. It would therefore seem reasonable to assume that, where many people are congregated in one place, the virus is more prevalent, and consequently one is more likely to encounter it at an early age. This results in one of three things: a mild form, which may or may not be recognized, but which will leave a lasting immunity; an acute form, which may leave a permanent defect, but also a lasting immunity; or else death.

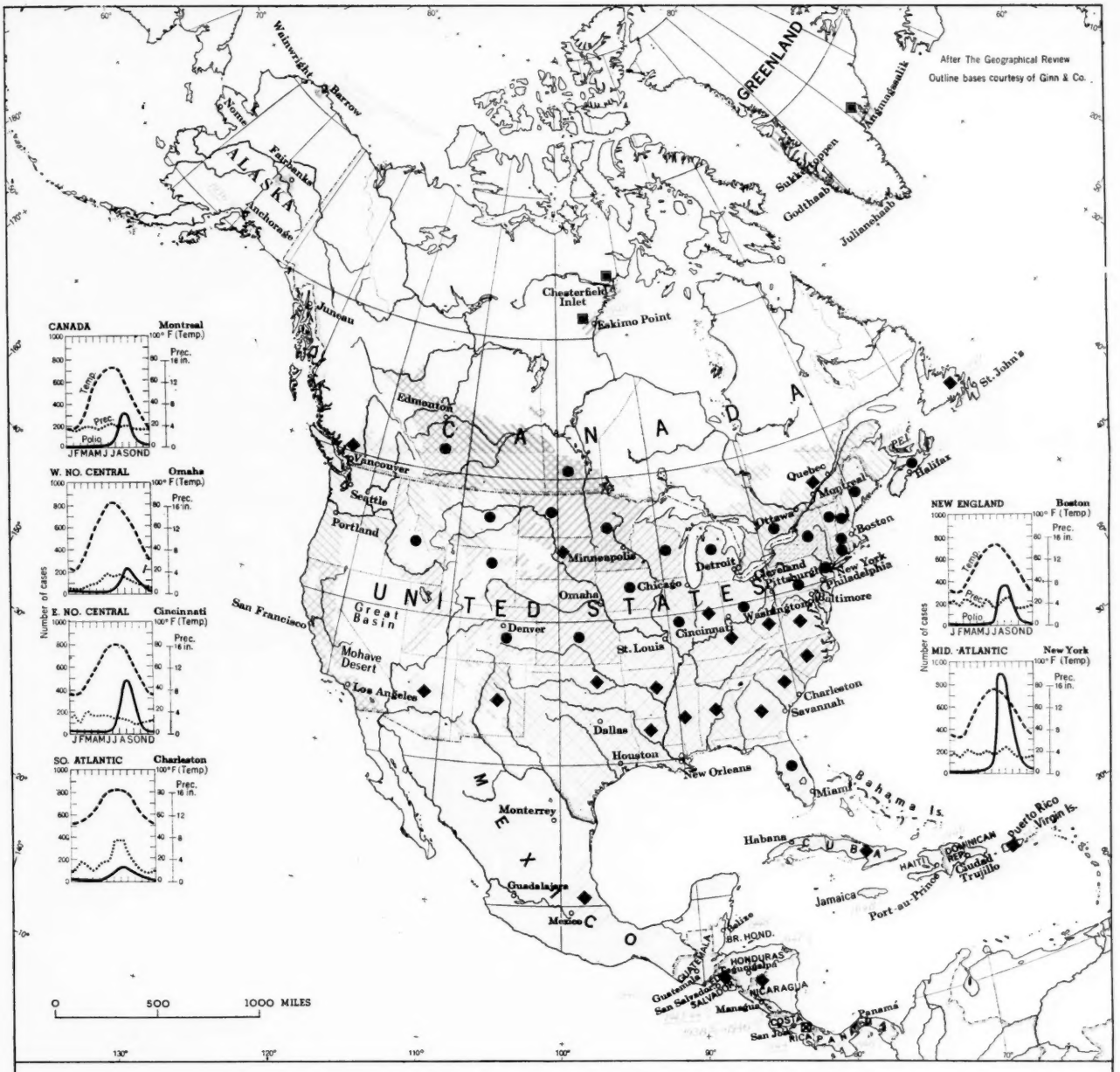
A fact that appears to support this theory is the extremely high number of cases and deaths that occur when polio strikes a sparsely populated and remote area such as the Eskimo communities in Northern Canada or some island in the Pacific. In such virgin territory all age groups are equally attacked. If New York had ever experienced the same proportion of cases and deaths as Chesterfield Inlet did during the 1948 epidemic, one-quarter of the population, or two million people, would have been hit, and of these about half a million would have died.

Another fact that is perhaps significant is the number of polio cases among United States troops in foreign lands. More cases have occurred among troops stationed abroad (except in Northern Europe) than among those who remained in America, and, strangely enough, the highest number of cases were found in areas where polio was believed to be rare, and epidemics infrequent, among the native inhabitants. Equally strange is the fact that these soldiers contracted polio at an age when one would have expected few of them to be susceptible, to judge by the small number affected among troops of the same age who remained at home.

It may well be that the prevalence of polio in certain countries has been underestimated because of inaccurate statistics. It may also be that the American soldiers were exposed to a new strain of the virus, to which the native population had become immune but which the transplanted soldier was unable to resist. Indeed, it is known that there are several strains of polio virus; each may have certain geographical limits, and an immunity built up at home may not hold in another area.

A correlation has also been established between the level of income and the age at which one is most likely to be attacked. The lower the income, the higher are the chances of early infection. Overcrowding in the poorer families brings the child into contact with the virus early and often. This may explain why in the Southern States (with the exception of Florida, where the standard of living is higher), it is the one- to five-year-old children that are the most susceptible. In the North the virus is less likely to be met early in life; consequently, there are fewer immunized people and a greater number of susceptibles, and epidemics are more frequent and more severe than in the South.

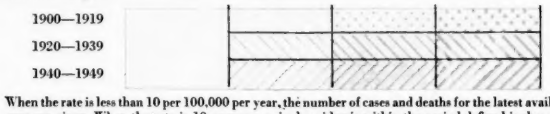
All this would seem to indicate that if the number of people in a given place who have become immunized to the polio virus during infancy or early childhood is small, there is a good chance for an epidemic to occur whenever the virus appears. Conversely, if the number of people between the ages of one and




## DISTRIBUTION OF POLIOMYELITIS 1900-1950

**MORBIDITY RATES**

When less than 10 cases per 100,000 inhabitants per year are recorded, or prevalence of the disease is reported without statistical notation, the occurrence is indicated by a pink tint within the generalized limits of the principal populated areas. When the rate exceeds 10 cases per 100,000 inhabitants, the peak morbidity rates reached in each period defined are indicated by rulings or dots of varying weights.




When the rate is less than 10 per 100,000 per year, the number of cases and deaths for the latest available year are given. When the rate is 10 or more, a single epidemic within the period defined is shown by underlining the year of occurrence and by showing, when available, the number of cases and deaths. When several epidemics have been reported within the period defined, the dates and statistics are not indicated.

Example of single epidemic: Eskimo Point year $\frac{\text{cases}}{\text{deaths}}$

**AGE GROUPS PREDOMINANTLY ATTACKED**

⊠ under 1 year ◆ 1-4 years ● 5-15 years ■ evenly distributed

**NEUTRALIZATION TESTS (LANSING STRAIN) AND PERCENTAGE OF POSITIVE REACTIONS IN SELECTED PLACES**

Example: Virgin Is.

**GENERALIZED LIMIT OF PRINCIPAL POPULATED AREAS**

fifteen who have encountered the virus early is large, the chance of an epidemic will be proportionately smaller.

The degree of sanitation also seems to play a role in the pattern of epidemics. Where sanitation is well advanced, as in the United States, there has been a constant reduction during the past 50 years in the rates of attack for children under five years of age, so that today this group is no more likely to acquire the disease than are the older groups.

We do not yet know exactly why. Neither do we understand, for instance, why the number of cases and deaths is lower among girls than among boys, and lower among colored people than among whites in the same locality. But it is obvious that the geographer can do much to help find, record, map, analyze, and interpret the human and physical factors that influence the distribution of the disease, and thus bring us closer to a knowledge of its habits and paths, and help change or avoid the environment where it thrives.

For many of us it is impossible to escape heat and humidity and some degree of overcrowding during the polio season, and perhaps little benefit can be expected from the hospitalization of a known patient, since 99 other apparently healthy individuals may be carrying the virus and giving it to any susceptibles they meet. But we should endeavour to take precautions against possible transmission agents. Polluted material is dangerous: the virus has been recovered from fecal matter and sewage. Flies and cockroaches should be kept out of our houses; they are suspect, not only because of their close association with sewage and fecal matter, but because they have been found to harbor the virus. It is quite possible that these insects play a role in the spread of the disease, but it is by no means proved that this role is important or unique; there may be many other, as yet unknown, methods of transmitting the infection.

The best possible protection against polio would be, of course, the spread of immunity. This could be accomplished only by creating artificially a mild form of the disease that would confer the same immunity as is produced by the mild forms spontaneously contracted. Although there are hopeful signs that the discovery of an immunizing injection may not be far off, today our only real protection is the avoidance of the propitious environments and the known carriers of the disease.

J.M.M.

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